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PRACTICE EFFECTS IN FREE ASSOCIATION

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While it is difficult to believe that any extended series of association experiments could be made without the appearance of some trace of practice effect, there has yet been no occasion, within the writer's knowledge, for the presentation of any systematized study of these effects. To make such a study with any degree of satisfaction requires a much larger series of stimulus words than is usually requisite for the immediate purpose of association experiments. For the present study, a list was constructed to consist of one thousand different stimulus words, which should be so far as possible unambiguous, and familiar to the class of subjects dealt with. These words were written on as many separate slips of paper, which were then placed in a large box and thoroughly shaken together for 15 minutes. The slips were then drawn from the box at random, one at a time, and made up into twenty series of 50 words each. A revised list will be an improvement over this one, which has, however, shown entirely sufficient adaptability to the present experiments.

One series of 50 words was given to each of six subjects each day, six days in the week, until the entire twenty series had been given. On the next two days the first two series of 50 words were repeated. The present results are based essentially upon these experiments, totalling 6,600 observations; especially on the two series that are repeated. Two other subjects reacted to 500 words each. About a third as many

more observations were made with each of the first six subjects, with reference to special points in the experiment, but these results have only a limited application for the present purpose since the experimental material was here varied somewhat for the different subjects.

While regretting that there is no more accurate method of timing than the stopwatch, which permits other essential conditions of the experiment to be satisfactorily preserved, it must be acknowledged the most useful method available for timing the individual responses of the experiment. It was employed in all the observations here recorded. I have elsewhere spoken very distrustfully of this method, and it cannot be used for the interpretation of single measures on a minute scale. This is owing partly to the inherent coarseness of the measure, partly also to the inaccuracies of operation. In the present discussion the changes are sufficiently great as to be reliably reflected in this method of timing, which modifies the external conditions for the subject less than any other.

Of the six subjects with whom we are principally concerned, one is a highly educated physician in middle life, the remainder are women nurses, with one exception under 30 years of age. In Jung's classification of association types, four of the subjects belong to the *Sachlicher Typus* tending in different degrees towards the more subjective types; one is a fairly distinct *Prädikattypus*, and one rather a *Konstellationstypus*. The two other subjects, VII and VIII, are also women nurses under thirty, one being a *Sachlicher Typus*, the other a less marked *Konstellationstypus*.

The progressive changes in the time of the response, and the qualitative changes shown by the responses in the repeated series, form the basis of the present discussion. The most noticeable practice effect is that in reaction-time; the changes in the content of the responses are perhaps of an equally interesting nature, but hardly so well defined.

The accompanying cut illustrates the practice curve of the association time for each subject during the twenty consecutive daily series. The time unit, here as elsewhere, is $1/5$ of one second.

The range of individual differences at the beginning of practice is here about 2:1, a range that is seen in many mental measurements, but in other observations with a larger number of subjects, this range is seen to be much nearer 3:1. The fastest subject here is about as fast as the writer has ever observed, but in other subjects from this group the median of 100 association times may run as high as 20 fifths, as in several of the series with subject VIII. The reaction times in the present experiments also run somewhat longer than those

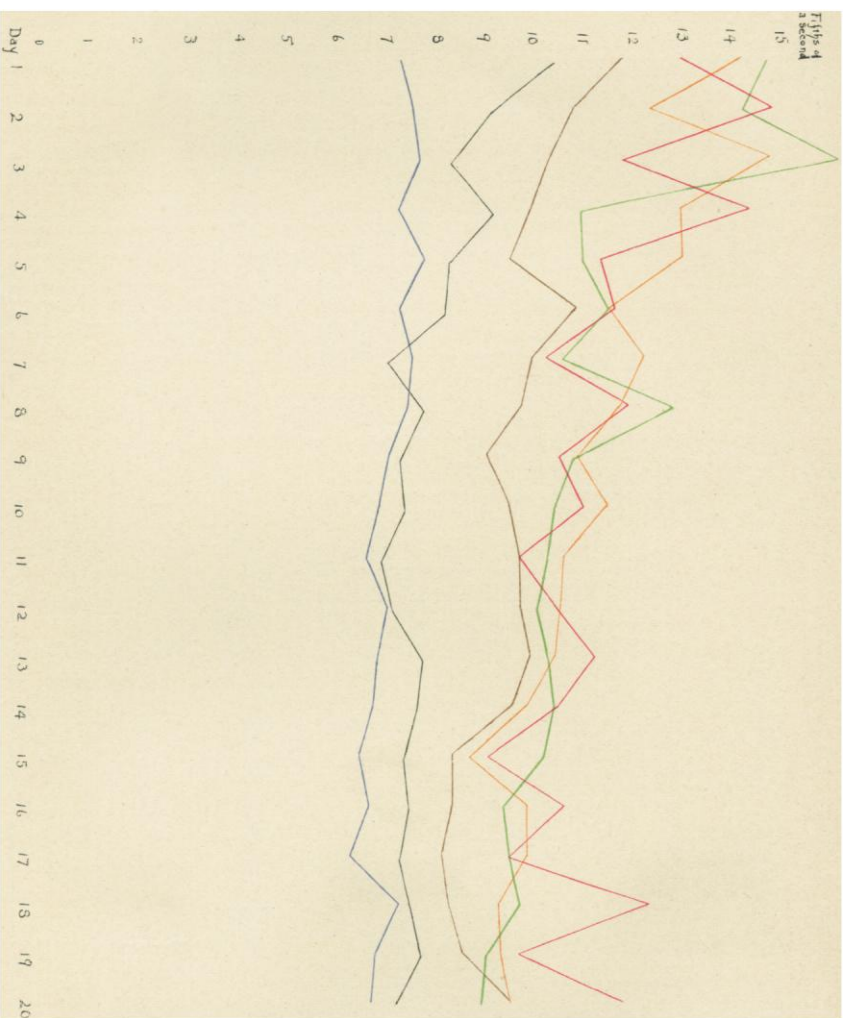


PLATE I.

reported by Jung, which, however, is amply accounted for by the greater difficulty of the individual series of words. A random selection of fifty from a thousand available words is naturally more difficult than a list of one hundred or two hundred words selected immediately.

The effect of practice seems to be towards a diminution of the individual differences in association time, although such a diminution is far from being what is found in all mental functions. Between three of the subjects (RED, ORANGE and GREEN) there is practically no such individual difference at any stage of practice, but in general the effect of practice seems to be to bring all the subjects near together at a certain psychological limit of quickness, which limit shows comparatively little individual variation. There are, therefore, very great individual differences in the closeness with which the different subjects approximate to this limit at the beginning of their practice. Thus subject BLUE starts well below any level which most of the subjects ever attain, and remains at this level throughout, the practice effect being almost absent so far as the association time is concerned. Other individuals have been observed, who, during the first observations with this test approximated to the short times here given by BLUE, and might be expected in further experiments to show as little practice effect. It seems fair to infer that the limit of quickness which any subject can attain by practice in this experiment, is equalled, if not surpassed, by other subjects at the beginning of practice, and these subjects then show little change during special practice. Some are born with the capacity for the promptest reaction, others achieve it only with special practice, and in very different degrees; still others perhaps not at all. And the general mental characters which give to one individual an inherently short association time are probably of a much more fundamental nature, and more important factors in the individual's make-up than those special characters which, developing during special practice, may give to another subject a somewhat greater facility in reacting.

Of the two subjects reacting to 500 words only, Subject VII shows nothing out of the ordinary, but the case of Subject VIII who shows an actual reverse of practice effect, is naturally of special interest. She seems to have a fairly good idea of the cause of the difficulty, which she describes as essentially a difficulty of choice between the large numbers of responses that would present themselves. Of this she is able to give quite detailed introspection in individual cases. She spoke of a difficulty in sufficiently focussing the "attention" *verbo ipso*. She said that the novel experimental conditions had

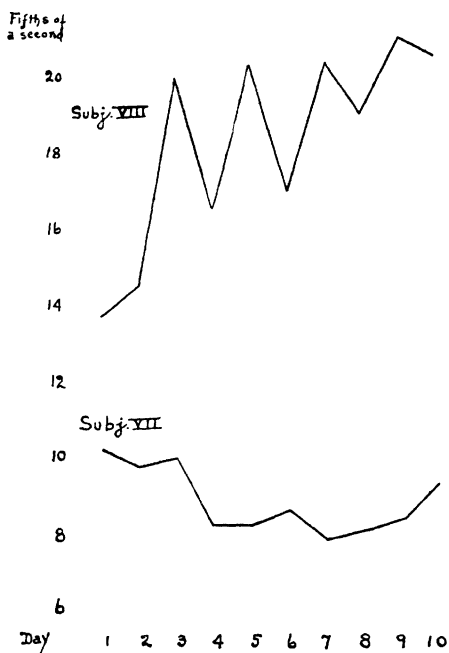


PLATE II.

“rattled” her a little only on the first two days, when as a matter of fact she was quickest. She denied absolutely that any conscious suppression of disagreeable associations had influenced the results and was able to definitely assign such a process in but one specific instance. It may be added that the subject is of an entirely normal make-up, and in education, mental balance, and professional efficiency, will bear comparison with any other member of the group.

One of the most unfortunate limitations of the median as a measure of central tendency is the fact that, unlike the average, it has no convenient index of the variability of the distribution about it. As a rough and ready index of the variability of the association times in each of the different series of fifty words, has been taken the smallest number of steps required to include 50% of the cases. Like the median itself, however, this measure takes no account for the extra long times but gives only an indication of how closely the central reaction-times are crowded together. In magnitude, this figure varies between 1.5 and 9 fifths of a second. As the time decreases with practice, the variability naturally drops also, although the record of Subject BLACK, in whom the

variability remains practically constant throughout, shows that it does not necessarily do so. The fluctuations in variability are more marked, and the individual differences less distinct, than in the curves of the reaction-times themselves. The variability of ORANGE is somewhat, that of BLACK, very disproportionately low. These are also the two most intellectual subjects in the group, although widely differing in their association types.

The distribution of the individual reaction-times in the single series of fifty words show a rather interesting fact that is contrary to what is ordinarily expected in such distributions. At no time during the practice is a distribution of marked skewness the rule. The mode is frequently as many as five steps away from the shortest reactions, and even during the final stages of practice there occur distributions exhibiting considerable skew towards the *long* end. Beyond the above decrease in variability, it is difficult to state any specific effect of practice on the form of the distribution. The natural interpretation of this is that an indefinite amount of practice would still leave us a considerable distance from the physiological limit of association time (which is more nearly approached in the controlled associations), and the limit of free association time, dependent as it is upon the most delicate interplay of the higher mental processes, is of too fluctuating a nature to leave any characteristic impress on the form of the distributions.

Contemporaneous with the free association experiment, the first five women subjects underwent practice in two other psychological tests. These were the Kræpelin addition test and a special form of the *A*-test, both of which belong to the general group of controlled association experiments. It is interesting to compare susceptibility to practice in these tests, which involve the continual repetition of the same or a few different associations, with the susceptibility to practice in the free association test, where the experimental task is a novel one in each individual observation. For present purposes it will suffice to compare the mean performance of the first two records with that of the last two for the period of twenty days. In the number-checking test it is more desirable to take the last two of the entire thirty days for which the function was practiced. This comparison gives us the following table:

FIGURES EXPRESSING THE PER CENT. OF PRACTICE IMPROVEMENT IN THE
FREE ASSOCIATION, THE ADDITION, AND THE NUMBER CHECKING
TESTS, INDICATING THEIR COMPARATIVE SUSCEPTIBILITY
TO PRACTICE

(The Lower the Figure, the greater the Practice)

Subject	Free Association	Addition	Number checking
BROWN	80	61	52
RED	74	52	81
ORANGE	70	55	52
GREEN	61	61	55
BLUE	89	49	41

In the case of the physician (BLACK) the practice in free association was 75%. In these figures it appears that while the practice improvement is practically always least in the free association test, it is nevertheless of the same order of magnitude save only, perhaps, in Subject BLUE. This is a striking result in view of the essential differences in the experimental tasks. In the individuality of the successive situations it presents, the free association test is unique among psychological experiments. It affords small opportunity for making any given association path more open through frequent use. Such a conception of practice fails when applied to the results indicated in the present experiments. It is therefore a question how far the practice in the number-checking test and in the addition test is of the same type, and the product of the same causes, as that in the free association test. The essential features in the free association practice can probably be cleared up only through the most accurate introspection, although it is a very natural interpretation to conceive of it almost wholly in terms of a removal of inhibitions. These decreasing inhibitions can for the present be only loosely figured as a greater accustomedness to the experimental conditions, a lessened emotional reaction to them, feeling freer and more at ease, less liability to distraction, and the like. They are essentially conscious inhibitions, although it is not easy to describe them accurately unless one has had some practice in introspection. We can probably reduce all these factors to the general term of the *elimination of the inessential*. The part which is necessarily played by this *elimination of the inessential* in the reduction of free association time throws a not uninteresting side-light upon its possible importance in other sorts of practice, where, owing to the fact that there is more repeated traversal of the same association paths, we may tend to place the burden of explanation rather upon decreased resistance in the path itself.

So much for the practice effect on association time. With regard to any possible effect on the nature of the responses, may be first noted the number of times the same response is repeated during the same hundred words at the beginning and end of the practice. This per cent. of the repetition is calculated for the two series that were repeated, thus for the same stimulus words, and forms a basis for some striking comparisons. The per cent. of repetition before practice and after practice is as follows for the different subjects:

Subject . . .	Black	Brown	Red	Orange	Green	Blue
Before Practice	8	11	14	16	17	13
After Practice	8	7	7	4	22	8

The regular tendency is to reduce the number of repetitions. In the case of GREEN the increase is essentially a matter of the subject's developing a "set" towards reacting with such responses as *large*, *small*, and *grand*, whenever they were available. With the exception of the physician, the remainder tend to particularize their responses more, as their practice in reacting gives them greater *Sprachfertigkeit*. It seems likely that BLACK, with his much greater initial *Sprachfertigkeit*, had already developed the quality that makes for decrease in repetitions beyond the point where practice would bring out any special change. The general trend towards greater particularization of the responses by practice, of which the decrease in repetitions is an aspect, will be discussed below in greater detail.

Further individual difference appears in the frequency with which a given stimulus word elicits the same response in both the initial and the repeated series, the figures on this point being as follows:

NUMBER OF CASES IN WHICH THE SAME RESPONSE WAS GIVEN BOTH BEFORE AND AFTER PRACTICE¹

	Black	Brown	Red	Orange	Green	Blue
Average number of identical responses in the two repeated series	16	22.5	20.5	9.5	21.5	22.5
M. V. of this average . . .	2	2.5	4.5	.5	1.5	1.5

Save for the probably negligible incidence of the memory factor, the number of times in which a different response is given is in the nature of an indication of the adaptability of the individual's thought processes; that is, of the capacity for differential response in relatively similar external situations. This is somewhat complicated by the factor of special education, because an educated subject possess an artificial

¹ There are a few cases in which the stimulus word was not understood the same in the repeated as in the original series, but these are negligible for the results. While it is not strictly a practise phenomenon, it is worth quoting for comparison with the above. (Fuhrmann.)

capacity to differentiate his responses more than an uneducated one. Thus, as above, the physician again gives a relatively small number of repetitions of the responses under these conditions. But of the women subjects who have approximately equal education, ORANGE differentiates her responses a great deal more than any of the others, more even than the physician; and she is the same subject who made the greatest gain in differentiation in the previous table. It may or may not be a coincidence that this subject has been placed in more responsible positions, also credited with more than ordinary *resourcefulness* in her professional work. And however much one might naturally incline to stress the merely educational explanation of this greater differentiation of responses, one must never forget that superior education to a certain extent implies superior ability to acquire it, in the fundamental dynamic correlation between superior innate endowments, and superior opportunities for developing the powers which they confer.

For these differentiated responses, there then presents itself the question of whether they are differentiated along any particular lines; *i. e.*, of whether the response, besides changing in form and in content, tends also to change in association type.

Before attempting to consider any possible effect of practice on the form of association, it must be thoroughly understood that the ordinary means of classification are at best very subjective. Such categories as the *Sachliches Urteil* and *Werturteil* are wholly continuous, even though they may cover a considerable range, as from a commonplace predicate like *handkerchief—white*, to such a highly particularized reactions as *journey—distasteful*. These last are what Jung calls the "egocentric predicates." The same continuity exists, of course, between the *Eingeübte sprachliche Verbindungen* and the *Sprichwörter und Zitate*; thus one might with equal justice assign *citizen—Roman* to either group. The most unfortunate confusion, however, is that likely to arise between these language-motor responses and those from the upper associative categories. Every experimental series is replete with reactions where this vital distinction is itself largely a matter of "*persönliches Werturteil*." *Only—chance* and *never—settled* may be harmless *Geläufige Phrasen* or highly egocentric predicates. *Betray—criminal* may be a *Subjectverhältniss*, an *Objectverhältniss* or an *Urteil*; *spread—feast* an identity or a predicate; *lady—gentleman* an opposite or a co-existence. The stimulus *cart* may elicit the response *horse* through the medium of word-compounding, familiar phrase, or co-existence. Shall we call *itch—scabies* an identity,

a co-ordination, or a Kausalabhängigkeit? *Fun—loving* a Wortergänzung or an Urteil?

Such examples could be multiplied indefinitely but are, perhaps, sufficient to show the character of the difficulties encountered in attempting an impartial classification of associative responses along the conventional lines. If available, reliable introspective data would go far towards removing them, but the very nature of the experiment usually renders this aid impracticable. With the more recondite responses, such classification is nearly meaningless. The interpretation, without reliable introspective data, of such reactions as *pole—legs*, *satisfy—savage*, *almost—conditional*, *enough—period*, *expect—to-morrow*, *justice—execution*, and the like, is little more than guesswork.

Subject to these reservations, then, the forms of association here justifying separate consideration may be enumerated as follows:

<i>Description</i>	<i>Approximately corresponding to Jung's</i>	<i>Example</i>
1. Failure of response	Ausbleiben des Reaktionsworts
2. Egocentric	Egozentrische Reaktion Direkte Ichbeziehung	succeed—I must
3. Egocentric predicate	Egozentrisches Prädikat	lonesome—never
4. Judgment of quality	Werturteil	rose—beautiful
5. Simple predicate	Sachliches Urteil	spinach—green
6. Subject relation	Substantiv-Verbum Subjektverhältniss	dog—bite
7. Object relation	Substantiv-Verbum Objektverhältniss	deer—shoot
8. Causality	Kausalabhängigkeit	joke—laughter
9. Co-ordination	Beiordnung	cow—horse
10. Subordination	Unterordnung	food—bread
11. Supraordination	Ueberordnung	rat—animal
12. Contrast	Kontrast	sunlight—shadow
13. Co-existence	Koexistenz	engine—cars
14. Identity	Identität	expensive—costly
15. Language—motor	Eingeübte sprachliche Verbindungen, etc.	town—state
16. Word-compounding or completing	Wortzusammensetzung, Wortergänzung	side—board
17. Pure sound associations	Reime	pack—tack
18. Syntactic change	Syntaktische Veränderung	deep—depth

The categories are divided into three groups. In the first group are those usually implying a special emotive element in the association; the second contains the more intellectual associations, while the very superficial associations are summed up in the third group. The associations from the present

material not falling into any of the above categories, it is impracticable to classify with any pretence of objective validity. They are also negligible in number, and indeed, several of the specified categories are very meagerly represented.

The tables indicate that in BLACK the type of association has undergone no particular change, except for trebling the number of contrasts, and halving that of the subordinates. The number of supraordinates, however, is remarkably small, which is significant in connection with this subject's superior education, and the tendency elsewhere for the supraordinates to decrease with practice. In BROWN, the responses show a slight tendency downward in the scale, and a considerable decrease in the supraordinates. In RED, this downward tendency of the associations is more marked, there being also a loss of half the supraordinates, which become mainly co-existences, these trebling in number. There are six of the third group of associations in the repeated series, to none at all in the original ones. And in respect to form of association, ORANGE again shows the most marked change of all. The predicates, many of which are quite egocentric in character, are decreased by about one-half, being relegated mainly to the language-motor, the word-compounds and the co-existences. There are also less than a third of the original number of supraordinates, these again becoming mainly co-existences and language-motors. Consequently these lower forms of reaction are greatly increased in number, there being 47 of them in the repeated series compared with 16 in the original. Notable is the total absence of contrast associations, also in Subject GREEN. The reactions of GREEN show no special change in type, except for the same decrease in the supraordinates, which here change to such responses as *large*, *small*, *grand* (as noted previously), technically predicates, but it is doubtful whether they are actually much more than language-motors. BLUE, however, shows a peculiar tendency to change the associations originally supraordinates to predicates of a higher order; *e. g.*, *donkey-animal*, *donkey-bray*. The lower categories are also better represented than at the start, so that the general result is to make the association type more variable than before. The remarkable shortness of the times in this subject will be remembered, and the responses themselves show rather greater superficiality than can be indicated in the classification.

In the totals, two main trends are apparent, which, however, cross, and to some extent mask, each other. First, the tendency, especially mentioned for some of the individual subjects, for the whole body of responses to move down in the scale of associations, and secondly, the tendency to greater

According to this system, it seemed that the associations in the two repeated series were most reasonably to be classified as follows:

CHANGE IN THE TYPE OF ASSOCIATION TO THE SAME STIMULUS WORD AFTER PRACTICE ASSOCIATION TYPE.

Subject	Black		Brown		Red		Orange		Green		Blue		Total	
	before	after	before	after	before	after	before	after	before	after	before	after	Practice	after Practice
1. Failure of Response	3				1				1				5	1
2. Egocentric (Direct)	1	1	1	1			11	7					14	8
3. Egocentric Predicate	4	3	1	2			14	5	19	20	2	6	45	39
4. Judgment of Quality					5	3								
Total													65	48
5. Simple Predicate	3	5	4	6	2	3	8	5	13	13	1	4	31	36
6. Subst. Vb. Subj.	4	6	1	1	2	2			1	1	2	4	4	6
7. Subst. Vb. Obj.	4	4	3	2	2	3	5	2	2	7	3	5	19	25
8. Causality	4	4	1	1	3	4	1	1	1	4	5	4	14	18
9. Co-ordination	22	26	22	21	19	21	9	13	5	8	15	17	92	106
10. Subordination	17	9	3	4	2	3	2	10	3	2	2	5	29	33
11. Supraordination	4	5	21	14	34	17	34	10	25	15	27	11	145	72
12. Contrast	3	9	3	4	6	6					8	6	20	25
13. Co-existence	14	10	10	13	5	16	9	17	2	3	15	10	55	69
14. Identity	12	12	27	25	19	18	5	5	24	22	18	19	105	101
Total													514	491
15. Language-motor	4	3	1	5	3	3	2	16	2	3	3	5	12	35
16. Word compounding or completing	4	3		1	1	1	9		1	1		3	5	18
17. Pure Sound Reactions	1	1											1	1
18. Syntactic Change					2	2	1				1	3	2	6
Total													20	60

Grand Total, 599 responses in each column. One stimulus word was unfamiliar to Subject GREEN.

particularization of the response as indicated mainly in the decrease of over 50 per cent. in the supraordinates. The latter is closely related to the decrease in repetitions described on page 7, for these repetitions consist largely of such supra-ordinate responses as *animal*, *food*, and the like, which have many subordinates among the stimulus words. For obvious reasons, these classifications do not lend themselves readily to further illustration of this tendency. It is plain what great individual differences there are in the amount of change of association type, but it is not easy to say just what ultimately constitutes these differences; they are not closely related to education. One is practically reduced to the tautology that as practice tends to lower the association type and to decrease the supraordinates, those individuals are most liable to practice effects who show the upper levels of association type, or a marked tendency to generalization in their responses. The *Sachlicher Typus* certainly shows the less change in association form, and probably also in reaction time.

The precise nature of these changes will perhaps be made clearer by the following illustrations. The comparative association times before and after practice are given, as usual, in 5ths of a second.

Stimulus word	Response before Practice	Response after Practice
<i>Greater Particularization</i>		
ancient	man 11	and Honorable Artillery 10
bank	building 13	England 9
contrast	judgment 46	black and white 8
dog	animal 22	Airedale 16
engine	machine 10	Morris Heights 21
herald	king 8	Globe 7
little	child 16	statue 12
parlor	room 8	sitting-room 7
swift	runner 12	Mercury 17
wheat	vegetable 24	cream of wheat 15

<i>Greater Superficiality</i>		
axle	hub 11	grease 6
axle	wheel 9	tree 6
bank	money 7	banker 5
discretion(twice)	wise 22, 42	valor 11, 6
lady	refined 21	man 19
pancake	tough 12	flour 9
shadow	shade 16	wall 6
spread	distance 17	bed 7
suffer	weak 11	pain 4
weak	frail 10	strong 13

In spite of the tendency to greater particularization, it is not unnatural, in view of these latter instances, that such actual "Komplexmerkmale" as are given in the reaction time, and in the form of the association as well as in the content of the response, should also be somewhat reduced by practice. The subjoined instances will serve to show what is meant, though some of the most striking examples of this tendency are not included.

Stimulus word	Response before Practice	Response after Practice
breast	face 22	milk 10
common	loose 14	Boston 8
flirt	disgusting 26	bird 9
heaven	peace 18	hell 6
person	woman 40	body 9
rat	ugly 27	large 10
sister	(Anna) 25	brother 7
virtue	good 18	reward 7
want	cherish 38	wish 9
whiskey	dangerous 13	Bourbon 7

The "complexual" character of the responses is apparently much diminished. This phenomenon should be attributable mainly to decreased emotive value in the stimulus-words, and only very sparingly to any greater expertness in dodging. In the above instances, the time is rather short for dodging, even though the occasion had presented itself. In this connection, it is well to bear in mind that special emotional reaction to a stimulus word may be a *product* of long association time as well as a cause of it, since the greater the tendency to hesitation, the greater the opportunity for emotive associations to be introduced. With greater facility of response, whether inherent or gained through practice, the importance of such a process is much reduced.

In brief, then, these experiments indicate the usual effects of practice on free association to be:

1. To decrease the association time to a limit approximating 6 fifths of a second for the median of 50 associations. At the beginning of practice, the subject may be any distance from this limit up to 15 fifths or more.
2. To further differentiate and particularize the responses, by increasing the readiness with which the subject's entire vocabulary becomes available for the purpose of such response.
3. To "flatten," or make more superficial, the form of association which the responses take.
4. To decrease the emotive value of the experiment, and consequently its applicability for all purposes involving its emotive value.